Review - Exam Final

1. **Chapter 1:** Terminologies
   - Two types of Statistical methods - Descriptive and Inferential Statistics.
   - Two types of Data - Quantitative and Categorical (Qualitative)
   - Sampling Designs
     a. Simple Random Sampling (SRS)
     b. Systematic Sampling
     c. Cluster Sampling
     d. Stratified Sampling (with proportional allocation)

2. **Chapter 2:** Descriptive Statistics
   - Graphical Procedures - Histograms, Stem-and-leaf Plot, Boxplot, Dotplot, Frequency/Rel. Freq, Table.
   - Numerical Procedures
     a. Measures of Center - Mean, Median, Mode.
     b. Measures of Spread - Range, Variance, Standard Deviation.
     c. Five-number summary.
   - $z-$score

3. **Chapter 3:** Definitions
   - *Experiment* - Any process of observation that leads to a single outcome that cannot be predicted with certainty.
   - *Sample Space* - Set of all possible outcomes of an experiment.
   - *Event* - A subset of the sample space.
   - *Probability (of an event)* - The chance of this event occurring.

   [Equally Likely Model] : $$P(E) = \frac{\text{no. of favorable outcomes}}{\text{no. of possible outcomes}}$$

4. **Review:** Properties
   a. $0 \leq P(E) \leq 1$; $P(S) = 1$; and $P(\phi) = 0$
   b. *Probability of the Complement*: $P(E^c) = 1 - P(E)$
   c. *Probability of the Union*:
   $$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

5. If A and B are *mutually exclusive*(*disjoint*) events (they don't intersect), then
   $$P(A \cup B) = P(A) + P(B).$$

6. **Counting Techniques:** Multiplication Principle, Permutation, and Combination.

7. **Conditional Probability** When $P(B) > 0$, the conditional probability of A given B is
   $$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{P(A \cap B)}{P(B)}.$$

8. **Independence:** Events A and B are said to be independent if and only if

$$P(A \cap B) = P(A)P(B).$$

9. **Total Probability:**

10. **Bayes Rule:**

11. **Chapter 4:** Discrete Random Variables

Values of X	x_1	x_2	x_3	$\cdots$	x_k
Probability	p_1	p_2	p_3	$\cdots$	p_k

where, every probability p_i is between 0 and 1, and $p_1 + p_2 + \cdots + p_k = 1$

   a. **Expected Value.** $E(X) = \mu = \sum_{i=1}^{k} x_i p_i = x_1 p_1 + x_2 p_1 + x_3 p_3 + \cdots + x_k p_k$

   b. **Variance.** $Var(X) = \sigma^2 = \sum_{i=1}^{k} (x_i - \mu)^2 p_i = (x_1 - \mu)^2 p_1 + (x_2 - \mu)^2 p_2 + \cdots + (x_k - \mu)^2 p_k$

   c. **Binomial Distribution.** $X \sim bin(n, p)$, That is

$$P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}, \qquad \text{for } x = 0, 1, \ldots, n$$

12. **Chapter 5:** Continuous Random Variables

   a. **Uniform Distribution.** $X \sim Unif[c, d]$.
   b. **Normal Distribution.** $X \sim N(\mu, \sigma^2)$.
   c. Normal approximation of the binomial distribution.

13. **Chapter 6:** Sampling distribution of $\bar{X}$ and the Central Limit Theorem.

   a. If $X \sim N(\mu, \sigma^2)$, then $\bar{X} \sim N(\mu, \sigma^2/n)$
   b. CLT. If n is large ($n \geq 30$), then $\bar{X} \approx N(\mu, \sigma^2/n)$

14. **Chapter 7:** Estimation and Confidence Intervals for one population. (μ, p, σ^2)

15. **Chapter 8:** Hypothesis Testing for one population. (μ, p,)

16. **Chapter 9:** Hypothesis Testing for two populations.

   a. $\mu_1 - \mu_2$
   b. $p_1 - p_2$

17. **Chapter 13:** Chi-squared Tests.

   a. Goodness-of-fit Test
   b. Testing Equality of Several Proportions
   c. Homogeneity Test
   d. Testing of Independence

18. **Chapter 10:** Analysis of Variance (ANOVA).

19. **Chapter 11:** Simple Linear Regression.